DOCUMENT RESUME

ED 219 372 SP 020 566

AUTHOR Anderson, Barbara A.; And Others
TITLE Population Dynamics.
PUB DATE 81
NOTE 49p.; In: Child Health and Human Development. An Evaluation and Assessment of the State of the Science. For related documents, see SP 020 557, SP 020 560-562, SP 020 564-565, and ED 215 792-795.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Birth Rate; *Demography; *Futures (of Society); Health Education; *Migration Patterns; Population Distribution; Population Growth; *Research Methodology; Research Needs; Trend Analysis

ABSTRACT

Research in population trends is reviewed in this report. The background of population research is examined in reference to methodology and costs. Research conducted by demographers and other population scientists are compared in four areas: fertility, mortality, migration and population redistribution, and population composition and change. Future directions for each of these areas are also discussed, taking into account such issues as methodology, timing, decisionmaking, and ethnicity. A list of 139 references is appended. (FG)

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Population Dynamics

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SP 020 566

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Acknowledgments

In developing this report, the Key Consultant received advice and comments from a number of persons and groups, and wishes to acknowledge the assistance of past presidents and members of the Board of Directors of the Population Association of America, the social scientists who are members of the Population Research Committee, National Institute of Child Health and Human Development (NICHD), members of the Ad Hoc Contract Advisory Committee of the Social and Behavioral Sciences Branch, NICHD, and directors of Center for Population Research center grants and training grants in population dynamics. Particular thanks are due to the following persons:

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Sidney Goldstein, Ph.D., Professor of Sociology and Director, Population Studies and Training Center, Brown University, Providence, Rhode Island

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Population Dynamics

I. Introduction

The World Health Organization has defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."[1] In a biomedical sense the term is often used to denote the incidence of or susceptibility to disease. It is also used in discussions of fertility and mortality and of population composition and change. In such instances health concerns are related to the research interests of scientists in the field of population dynamics.

Research on fertility may involve concerns in addition to biomedical health considerations. There are hypotheses, for instance, about the relation between female labor force participation and fertility. Some suggest that the amount of a woman's potential earnings is an important factor in deciding whether to have a baby; others emphasize preferences for particular lifestyles. Which of these is correct is important not only for reasons of individual health but also in terms of understanding fertility trends in the United States.

Mortality studies can have implications for social well-being. The incidence of widowhood, for example, affects housing requirements and may affect family living arrangements and social relations if children or other relatives feel obliged to house a newly widowed person. Moreover, the recent rapid decline in death rates at the older ages may affect social welfare, as seen, for instance, in demands on the Social Security system.

A long-established pattern of population loss in the American South was reversed in the last decade. Some aspects of migration to the South, particularly involving

older people, relate to health considerations and to demands for health services. Other aspects have important implications for the possible location of industry and for shifts in the distribution of the electorate.

The study of composition of the population by race and ethnicity is also important. Differences in mortality among groups and subgroups are reflected in health circumstances and in needs for health services.

II. The Nature of Research

Research in population dynamics encompasses four areas of study: fertility, mortality, migration, and population composition. Demographers and other population scientists work in such allied fields as sociology, economics, history, geography, anthropology, psychology, biostatistics, political science, and epidemiology. Within the theoretical frameworks of their disciplines, they use a variety of methods, including demographic and statistical techniques, to understand the determinants and consequences of population processes.

The study of population provides information relevant to public planning. Large public projects such as regional health centers or mass transportation systems, for example, have long lead times and construction periods, and their location and size must be planned carefully with reference to populations to be served over the course of several decades. Similarly, population trends have critical implications for the long-term viability of pay-as-you-go retirement systems, such as Social Security, where changing age structure and the age of retirement itself become major determinants of outlays. The labor supply, too, depends not only on the size of the total population in a locale but also on its age structure, education, and skills, and the propensity of women to seek paid jobs outside the home. Such employment is linked, in turn, to patterns of marriage, contraception, childbearing, and living arrangements. Immigration now accounts for a quarter of the annual increase in the U.S. population; its impact upon future growth and composition of population should be assessed.

At times research in population dynamics addresses an especially distinctive phenomenon. Research in such instances is multidisciplinary, since the tools and theories of a single discipline rarely provide an adequate explanation. The "baby boom" following World War II is an example, where insights from economics, sociology, and psychology, as

well as methodological tools from economics, demography, sociology, and statistics, were important in analyzing the event.

Scientific interest in what caused the baby boom applies to the attempt to improve the accuracy of predictions about future fertility trends. Easterlin[2] noted that the parents of the baby-boom babies were children during the Great Depression, and he speculated that people's ideas of the resources necessary for raising a child are formed during their own childhood and early adolescence. Thus, when faced with the prospect of parenthood, they decide how many children they can afford in terms of their earlier ideas. Relatively few children were born during the Depression, and when they became young adults in the late 1940s and 1950s, they had their pick of jobs and thus were relatively prosperous. They felt as prospective parents that they could afford families that were larger than the ones in which they grew up.

Easterlin's ideas led to a variety of hypotheses which he and others[3-7] have developed about the effects on later behavior of attitudes formed during childhood and about the effects of differing relative sizes of birth cohorts. (A birth cohort is a group of people born in the same time period.) These hypotheses blend ideas from economics, psychology, and sociology in exploring the way standards and tastes develop as a partial result of the economic circumstances of the total society and of the individual household.

A competing theory, pioneered by Becker, related fertility directly to income and inversely to the cost of childbearing. A number of investigators have found support for this theory.[8-10] The work of Butz and Ward[11] in particular has identified the cost of children as a particularly powerful variable in terms of both direct costs and opportunity costs as measured by the amount of wages the wife probably would have earned if she had not remained at home to raise children. This second theory draws directly on neoclassical economics. For both theories, methods from demography, economics, and statistics are essential in order to test their fit with observed behavior. Recent research has given hope that these two theories can be reconciled into a hybrid theory of fertility in developed societies.[12]

Methodology

The technical analysis of population interaction is called demography. Drawing heavily on mathematics, statis-

tics, and the various social sciences, the methodology of demography is one of the most advanced of the social sciences. Basic to demography, for example, is the life table, which is used by actuaries to set rates for life insurance and by industries to predict when machine parts will wear out. Life tables and other models are also used to assess such things as chances of survival following surgery, and of the probability of dying from a particular cause.

Special sets of demographic tools have been developed, and they have enabled population scientists to address key questions in fields such as sociology, history, and economics. As new questions arise, new tools are developed. Demographers, for example, construct mathematical and statistical models of complex processes, such as of pregnancy and birth.[13-16] Only recently have new models been developed to study marriage and fertility where records of marriage by age are insufficient.[17]

Demographers develop models largely because, like astronomers, geologists, and climatologists, they are seldom able to conduct planned experiments. Typically they test their theories by comparing results derived from models or simulations with data derived from actual situations. If a given model performs well in conforming with past experience, it can be used to predict results in situations that have not actually occurred. Models can be used, for instance, to predict the effect on fertility of a given change in contraceptive use or of a change in the pattern of separation of spouses.

In simulation exercises, such as those referred to, input parameters, such as the level of fertility or mortality, can be set at will, and statistical experiments (under a given set of assumptions) can be performed that would be impossible in the real world. Models of population-social interactions, for instance, can be used to assess the social and economic effects of long-term zero population growth at low levels of mortality, a situation that no society has yet experienced but which the United States and much of the more developed world may face in the near future.

Models of the effects on population growth of varying patterns of fertility, marriage, and mortality[18,19] can be used to estimate the impact of a decline in the death rate on proportions of the population at particular age levels. Such changes in the age structure have a substantial effect on demands for social services, including health services.

While much population research relies on the use of models, there are opportunities for direct experiments. Controlled laboratory experiments are conducted, and in a limited sense, approximations to laboratory experiments can

also be accomplished. Users and nonusers of particular types of contraceptives, for instance, can be followed for many years, and comparisons can be made between the two groups across a wide range of behavioral and physical factors. In addition, there are natural experiments that occur in "natural laboratories." The best situations for them often occur in other countries and sometimes in earlier times. Knodel,[20] for example, used historical information from Germany to study the effects of breast-feeding on intervals between births by comparing data from villages in which the average length of breast-feeding varied greatly. Similarly, data collected in Guatemala,[21] Bangladesh,[22] and Zaire[23] have been used in research on how a mother's nutritional state affects the length of intervals between births.

Useful insights are often obtained from such experiments. The Knodel study, for example, concluded that prolonged breast-feeding lengthens the interval between births among women who do not practice contraception, and also that such prolonged breast-feeding increases the survival chances of children who are born when overall mortality levels are high. In another study, stillbirth and infant mortality rates were calculated for very young mothers in the United States. A number of studies show that, although age is not unimportant, the problems for the embryo, infant, or child are more closely related to the socioeconomic status and prenatal care received by the mother than to the young age of the mother.[24-34]

While the current state of modeling of statistically controlled experiments and of the relatively rare natural experiments offers a formidable array of methodological tools, there remain many areas in which new methodological developments are necessary. These areas include comparative fertility research and patterns of increase in life expectancy at the older ages.

Costs

Compared to the costs of biomedical and some behavioral science research, the cost of much population research is relatively low; investigators frequently exploit government data collected for official uses. Thus, census data and vital statistics on births, deaths, and marriages may be combined with data on employment and other topics in order to study a wide range of questions. Although the techniques are statistical and sometimes complicated, they are still relatively quick and inexpensive. Long,[35] for example, used data from the 1970 census to show that black migrants to Northern cities, contrary to popular belief, were not dis-

proportionately represented on welfare rolls. Lee and Nelson used data from the Social Security Administration's Continuous Work History Sample to show that migrants into and migrants out of an expanding metropolis (Atlanta) enjoyed higher earnings after migration than before.[36]

The collection of original data is very expensive, but it is necessary when a unique question is of pressing importance. In order to better understand poorly nourished populations, for instance, data were collected in several Guatemalan villages for studies of the interrelationships among health, behavioral change, nutritional status, fertility, and infant mortality.[21]

Special data were collected relating to teenage sexual behavior, pregnancy, and the use of contraception.[37] Routine surveys, such as the Current Population Survey, would not have included enough teenage mothers for an adequate study of the subject, and large general data-collection efforts, such as the decennial census, would not include the specific questions needed for the study. The special data were necessary to inform decisionmakers on how to improve the health of teenage mothers and their children and for determinations of the motivations behind early teenage childbearing.

A new interest in population dynamics has focused on behavior and decisionmaking at the individual or household level. Testing of relevant hypotheses often requires specially designed household or individual surveys. (Their product is commonly referred to as "microdata.") Thus, relevant microdata have been collected on a relatively small sample of residents of an individual city or State, especially when these data can be merged with earlier data for a longitudinal analysis.[38]

III. Areas of Population Research

The causes and consequences of population structure and change are considerations in any discussion of population dynamics. A study of change in population size, for instance, targets a given geographic area between two points in time. It arrives at the difference, during that timespan, between the number of persons added through births and through inmigration and the number of persons lost through deaths and through outmigration.

Historical studies have been useful in planning population questions. A variety of data collected in the past are available, and the researcher has the advantage of being

able to consider a long timespan. Historical research has one major drawback, however, which is the inability to add pertinent questions to those asked in the past.

The dynamics of population change are important for a number of reasons. Changes in the total population of States are reflected in congressional representation. The demand for many health, educational, and other social services is generally related to the total number of persons in an area. In addition, the composition of the population is often as important as its total size. Particular age groups, for example, affect the demand for schools as well as for health and social services. If the elderly population of an area increases, the demand for health services is also likely to increase. Changes in the ethnic composition of an area are frequently related to demands for bilingual facilities, and the socioeconomic composition of an area corresponds to the need for various kinds of public programs.

Fertility

Research on fertility covers a broad range of topics. One of its most important and most-studied issues concerns the factors that motivate couples to limit the number of children they have. Researchers have approached the question through the use of both aggregate and individual level data and have employed sociological, psychological, and economic perspectives.

An important question in the area of fertility regulation is: What are the similarities and differences between Europe historically and less-developed countries currently in the causes and the patterns of the onset and spread of voluntary fertility control? It was once a commonplace notion that historical behavior in Europe conformed to a fairly simple model of change--namely, when countries become increasingly urban and workers move to industrial and service jobs, widespread voluntary control occurs automatically. Among urbanized populations, children are thought to have less productive value to the family, and as the variety of work roles increases, especially for women, alternatives to having children are seen as increasingly desirable options. The question is often asked why populations of less-developed countries do not follow the European model and similarly respond to socioeconomic changes with a fertility decline.

In order to determine whether this model describes historical behavior in Europe, the European Fertility Project investigated the pattern of decline in marital fertility

throughout Europe, using aggregate data by province. Coale and his colleagues[39] found that, when a province reached the point where a certain proportion of its population was working in nonagricultural jobs, lived in urban places, or had attained a given level of education, fertility did not automatically decline. Rather, some provinces became quite advanced before any decline in fertility occurred, and others demonstrated substantial control of marital fertility while their populations were still primarily rural and illiterate. The research did not supply definitive answers about the process of the adoption of fertility regulation, but it did increase knowledge by showing that the explanation is more complex than was once believed, and it is suggestive at theoretic and policy levels.

Taiwan has served as a large natural laboratory for testing a variety of hypotheses about fertility. Since the European research showed that, on a population level, the translation of educational and occupational changes into lower fertility is not automatic,[40] ongoing research in Taiwan has attempted to elucidate the mechanism further. Such research may help clarify the way in which this translation occurs. Economic research on population has always concentrated on individual or household decisionmaking processes. It seems that such an approach may be fruitful in the future in determining the role of the wife and other family members in family decisionmaking under a variety of circumstances.

Taiwan experienced rapid economic development after World War II and recently it has experienced a rapid decline in marital fertility. Research has determined that a couple's decisions on fertility are affected both by their personal characteristics, such as education and occupation, and by governmental policies relating to fertility regulation. It was found that under particular circumstances exposure to family planning programs increases the chance that couples will adopt voluntary fertility control.[41]

Current policy issues in the United States also relate to voluntary fertility control and draw on research such as that already discussed. The National Fertility Surveys[42] have provided extensive information about fertility patterns in this country. It was found, for example, that in 1965 the effectiveness of the type of contraceptive used by married women was strongly related to their educational level. By 1970, however, married American women tended to use effective contraceptives regardless of their educational level. Westoff and Ryder also found that, over time, Catholic and non-Catholic contraceptive practice and fertility converged substantially. Additionally, the researchers maintained that most of the recent decline in fertility levels among American blacks was due to their adoption of

more effective means of contraception, which allowed them to avoid unwanted births to a greater extent than had been possible earlier.

The issue of unwanted teenage pregnancy rests upon the question of how to motivate teenagers either to abstain from sex or to use currently available contraceptives. Studies suggest that the nature of the teenager's relationship with her partner and parents affects fertility-regulating behavior. Such findings contribute to new understanding for helping teenagers regulate their fertility.[43-58]

Another major area of research addresses the causes of fluctuations in fertility in developed societies. Studies have been directed to understanding why fertility fluctuates in the United States, in conditions where the capability for regulating fertility exists. The very low fertility of American women born during the first decade of the present century has been investigated by Ridley[59] to identify some of the social and economic factors that caused them to limit their childbearing, not only during, but also prior to the Great Depression. Other researchers have concentrated their attention on the unexpected resurgence of fertility among women who were born in the 1920s and 1930s.

Presently, American women in their late twenties and early thirties have very low levels of fertility compared to women at these ages in earlier decades. Whether women are simply postponing their fertility for a later "catchup" or whether they will maintain low fertility is a question of considerable debate. If the low level continues, it will be unprecedented in this country. If women catch up later, a fundamental change in fertility behavior at a population level will have occurred. In the past, fertility regulation has occurred most markedly after married women have already borne the number of children they want. Restricting fertility for 10 years or more and then having two or three children has not been a common pattern. Findings of studies by Freedman,[60] Ridley,[59] and Coale[39] are being used to try to predict American fertility behavior in the future.[61-63]

More studies comparing trends and relationships in different countries and regions will be essential to understand basic fertility relationships in general and in the United States in particular. The relationship between labor force activity and fertility in the United States is a single case from which generalizations cannot be made. Comparisons of it with the work-fertility relationships in a number of countries, however, can aid in identifying possible factors that determine current trends. An analogous situation exists in the study of inflation. More and more analysts find that understanding its causes in the United States requires them to study the similarities and differ-

ences in the economic situations and trends in other countries, such as Germany, Japan, Britain, and Israel.

Fortunately, the data and methodology for comparative studies in fertility are being developed. The vast amount of data generated by the recent World Fertility Survey provides an unprecedented opportunity for such comparative studies in collaboration with researchers in foreign countries.[19] Methods originally developed for the study of fertility in less-developed geographic areas, such as sub-Saharan Africa--although originally intended for simple parameter estimation--will be invaluable for these theoretic studies. In addition, general developments in statistical methodology will be essential in the future. It is increasingly clear that these problems call for an interdisciplinary approach. Both economic considerations and long-standing attitudes are likely to influence people in deciding when and whether to limit their fertility. In this connection, the techniques developed for microeconomic studies are becoming essential tools for researchers interested in household decisionmaking. At the same time, many researchers are also aware of the importance of attitudes in fertility behavior, and they draw increasingly on psychological, sociological, and anthropological concepts and theories.

Mortality

Investigators have been concerned with analytical studies of the relation of mortality to other demographic factors, such as changes in fertility, and to social factors, such as education or marital status. The interest of social scientists in mortality focuses on factors that affect an individual's chance of contracting a certain disease or dying and on the distribution of those factors in the population, rather than on the process by which a disease is fatal. Mortality and morbidity data are collected by many Government and local agencies, including the National Center for Health Statistics and local vital statistics operations. These data, in turn, are used by research agencies to make detailed analyses or test specific research hypotheses.

Before voluntary fertility control becomes widespread in a population, fertility behavior is seen to have a substantial effect on mortality. Research on historical data from German villages of the 18th and 19th centuries[20] has suggested that differences in breast-feeding patterns affect infant mortality rates substantially. Villages in which breast-feeding duration was typically short had much higher rates of infant mortality than villages in which the dura-

tion of breast-feeding was typically longer. Similarly, research on contemporary Bangladesh has shown higher mortality rates for children separated from the next birth by a short interval than for children whose next younger sibling was born after a longer interval.[64]

A popular explanation has been that the onset of voluntary fertility control in Europe was a response to declining infant and child mortality. The explanation rests on the idea that parents want a certain minimum number of children to survive to adulthood and that as mortality rates decline, they need to have fewer children to ensure the survival of that number. The European Fertility Project,[39] discussed earlier, casts doubt on this explanation. It shows that there was no fixed relationship between the decline in infant mortality and the onset of voluntary fertility control and demonstrates the need to know more about the relationships of one factor to the other.

A major controversy in the area of mortality is the extent to which medical advances and specific individual medical treatment affect levels of mortality, and the extent to which the level of sanitation and public health is related to an individual's chance of dying. A corresponding issue is the effect on health of an individual's overall socioeconomic status or standard of living apart from his or her specific health habits. Mortality conditions have improved much more rapidly in currently less-developed countries than was the case in Europe or the United States. Even though mortality rates are low in currently less-developed countries, their populations may not have robust health; their apparent good health may be a fragile state that would deteriorate rapidly if exposed to a previously unknown ailment. An understanding of the population-level determinants of mortality is also relevant to understanding the measures necessary to reduce mortality among subgroups of the American population, such as the inner-city poor, certain groups of native Americans, and many rural poor.

Demographic methods have made substantial contributions to knowledge of biological factors that affect populations. Analyses of Mormon genealogies, for example, using techniques from historical demography, have advanced the understanding of genetically related diseases.[65] Statistical techniques applied to the genealogies indicate that many kinds of cancer are more closely related to genetic factors than was suspected earlier.

Demographers have also been concerned with patterns in mortality data. Assembling a large set of mortality schedules from countries throughout the world for present and past periods, Coale and Demeny[66] found four different patterns of mortality change by age. In some populations, for

example, mortality below age 5 declined slowly in relation to mortality changes at other ages, and in other populations it declined more rapidly. Focusing on various geographic areas, Preston[67] conducted research on changes in the distribution of causes of death in relation to the decline of mortality, and found that patterns of changes in causes of death are related to patterns of change in mortality. For instance, advances in public health, such as improvements in water quality, reduce the proportion of deaths from infectious and parasitic diseases, which are particularly lethal to infants and young children.

Large differences in mortality conditions have been documented among various strata of the American population. Since World War II, female death rates above age 50 have declined steadily, and male death rates above age 50 have risen in some periods and fallen slowly in others. Preston[68] studied death rates by sex, cause of death, and smoking status and determined that the most likely explanation of the sex difference in these trends was widespread heavy smoking by men. His research supplemented the clinical biological research on the health effects of smoking. By linking 1960 death certificates and census returns, Kitagawa and Hauser[69] showed that those with little education had almost double the death rates of those who had attended college. In this study, blacks and native Americans had especially high mortality levels, and Japanese-Americans had extremely low levels. Later, Schoen and Nelson[70] demonstrated that in California, Americans with Spanish surnames have nearly as high a life expectancy as other whites. Although Americans with Spanish surnames have higher death rates from infectious and communicable diseases than do other whites, this difference is almost completely offset by lower death rates from cardiovascular disease and neoplasms. In fact, low death rates from cardiovascular disease characterize Latin-American populations.

Mortality differentials have helped identify important pointers to risk factors which are then further studied by laboratory and clinical scientists. Studies of mortality have also helped confirm at the population level the importance of risk factors identified in epidemiological studies. Males in Utah, for instance, have a very high life expectancy, which is probably related to a lifestyle that involves less smoking and less consumption of alcoholic beverages than in the general American population.[65]

Studies of mortality differentials also indicate how various population groups are being served by existing health systems, and they are useful in identifying target groups for special program efforts. In this connection, it is particularly useful to compare mortality differentials across countries[71] and over time in the United States.[72]

In brief, levels of and differentials in mortality are meaningful and precise measures that indicate the distribution of social and economic circumstances, among which improved health and longer life are the most highly valued.

Recent attention has been focused on declining mortality among the middle-aged and elderly population. The declines began in the late 1960s and were largely unanticipated. In response, the Census Bureau has increased by more than 3 million its projection of the number of persons over age 65 who will be living at the turn of this century. It now seems that yet another upward revision of the projection is necessary. Myers[73] and Manton[74] have made alternative projections of the elderly population by integrating the decline in mortality into a model of death, disease, and recovery that recognizes the interrelations among diseases.

A variety of studies suggest that social relations and living arrangements are important for health and longevity in the United States. Verbrugge[75] found that married persons of a given age tend to be healthier than currently unmarried persons of the same age. Kobrin and Hendershot[76] similarly found that among older persons those who live with others have less chance of dying in any given period than those who live alone. For both health and longevity, the benefits of living with others, such as when married, seem greater for men than for women, although women also generally benefit in health and longevity from living with others. It seems that this outcome is not completely a result of healthier persons' becoming married or living with others but rather a result of factors in the social context of not living alone that contribute to health and longevity.

Changing mortality levels also affect future demands for various kinds of housing. Schoen[77] showed that under conditions prevailing in the United States in 1960 a woman could expect to spend 8 years of her life as a widow, and a man 2 years as a widower. Thus, subject to marriage and mortality rates in 1960, the large majority of females would die in the widowed state. This statistic has major implications for residential arrangements of the elderly and for significant changes in housing demands in the future.

Social norms supported co-residence of parents and their married children to a greater extent in the past than now. Research on changing mortality levels suggests that although co-residence may have been ideally desired in the past, few married persons had parents who could have lived with them. This finding leads to the observation that it may be easier to hold a norm of joint residence if it rarely needs to be translated into actual behavior.[78,79]

Migration and Population Redistribution

As in the past, Americans migrate for reasons that are connected with national economic and social systems. A characteristic of modern economies is the quick exploitation of newly developed resources and knowledge, a process that requires the abandonment of old enterprises, such as the textile and shoe industries in New England, along with the development of the new, such as the transistor and semiconductor industries in California and Texas. These economies depend on migration, which continuously alters the population growth rates of localities. Without a tradition of migration in which people move from areas where jobs are dwindling to those where workers are needed, economic processes would be intolerably sluggish and imbalanced.

Migration is an important vehicle of social mobility as well. Many people are prevented from improving their circumstances not so much because of inherent personal deficiencies but because of discrimination and rigidly drawn social barriers in their home areas. The largely positive experience of blacks who left the rural South and of members of ethnic groups who departed from city ghettos confirms the value of the freedom to migrate in fostering improvements in personal status.

Why people move and with what individual and societal effects have been the subjects of considerable research. Although few universal statements about migration have been found to stand without exception, research does indicate some general patterns. People migrating over long distances, for example, tend to do so for economic reasons, such as taking a new job, whereas those moving locally act typically on neighborhood preferences and the need for a change in housing, as family members leave, infants are born, or relatives move in.

Understanding the migration process depends on the synthesis of findings arrived at through the exercise of several disciplines; economic, sociological, psychosocial, geographic, political, demographic, and other influences are all embedded in the migration episode. A scientist working from the perspective of economics, for example, would point to the human capital aspects of migration, gauge, for sending- and receiving-areas, the costs and benefits of migration flows, raise implications for local and regional economies, and, in the framework of the benefits and costs of moving, examine migration as a general investment problem. One working from the perspectives of sociology and psychology would point to underlying social structures that influence migration and to the orientations, attitudes, and values through which the influence is transmitted. Sociology, psychology, and economics merge in the

study of how large-scale social changes combine with persons' intentions to move.

The prospect of geographical mobility is especially appealing to individuals when they are at a time of transition in the life cycle, such as marriage, family expansion, entry into the labor force, divorce, retirement, or career change. At such points, migration becomes a more attractive option, but a large set of factors influences whether that option is taken.

Studies have shown that education and high occupational status are associated with migration. Those who are most disadvantaged at a given time are not necessarily the ones who are most likely to look elsewhere for new opportunities. Other studies have shown that certain kinds of individuals have a special propensity to migrate. Such persons contribute a disproportionate share of total population mobility. In fact, the longer a person has remained in one place without moving, the less likely he or she is to move in the near future.

Migration produces complex and subtle changes that are felt most immediately on the regional and local level. Just as population is replaced over time and grows naturally or declines as persons die and children are born, it can also grow, shrink, or be replaced through the movement of people to or from a place. Migrants may come from other places in the United States or from foreign countries, but they have one thing in common. Unlike infants, who enter the population at age zero, migrants enter at a variety of ages and tend to be concentrated in the prime working ages. Thus migrants often contribute directly to the workforce. To the extent that migrants come from cultural and socioeconomic settings different from the destination, they face potentially difficult and painful processes of adjustment.

As migration rearranges population in response to changing needs of the national economy, it also transforms communities and restructures regional political interests. Political effects are felt directly at the local and regional level, where growth often occurs as much from net migration as from natural increase. Growth or decline through migration has an immediate impact, whereas natural increase has no direct electoral consequences for at least 18 years.

A process analogous to the one in which Americans redistribute themselves in accord with economic opportunities is taking place in currently less-developed countries. One major phenomenon in these areas is the rapid growth of large cities, to which net inmigration contributes considerably. This rural-to-urban migration is only one part of massive socioeconomic changes in these countries and is

related to changes in land tenure and individuals' changing expectations about opportunities for themselves and their children.

Davis's work has helped focus attention on migration as an integral part of total demographic and social change rather than as an isolated topic.[80] He pointed out that in the process of socioeconomic development, when mortality declines in an area and the density of its population increases, outmigration is an alternative to a decline in fertility to relieve the pressure of population. More recent research has shown that concomitant with socioeconomic development, temporary migration often precedes permanent movement.[81] Frequent temporary absences by the male head of the household alter rural social structure and organization and often stimulate an increased involvement of children and old persons in agricultural work. The involvement interferes with the children's schooling and may be injurious to the health of the elderly. Such circulatory movement may be detrimental to health in a society as well as conducive to the spreading of disease.[82]

In their urban destinations, migrants affect the nature of life and the demand for services. The process of change in occupation, outlook, and behavior--including fertility behavior--among migrants to urban areas in countries such as Thailand,[83] Zambia,[84] and India[85] has been a major topic of interest.

In currently less-developed countries, migration and urbanization affect and are affected by the health status of various parts of the population. Migration of large numbers of former rural residents into urban areas often increases the measured levels of fertility and mortality in the area, and migration among various parts of a country that were formerly isolated may spread a previously unknown disease, to which the local population has little resistance.[82] On the other hand, health facilities are typically much better in urban than in rural areas. Vaccination programs are conducted first and most effectively in urban areas, and a desire for good medical care is often a reason for temporary or permanent migration to urban centers. Successful family planning programs often start in urban areas and later spread to rural areas, through both temporary visits of rural residents to urban places for family planning supplies and dissemination of information from urban to rural places about family planning opportunities and techniques. The findings of such studies are particularly relevant to research on migration to urban places from the poorer regions of the United States, such as the Mississippi Delta and Appalachia.[86]

Research on the effect of migration on migrants of rural origin and on their adaptation to urban life is also

relevant to understanding the adjustment process of both documented and undocumented aliens in the United States. Migrants to the United States from Mexico, Viet Nam, and other parts of the less-developed world face adjustment problems that are similar to those of rural-to-urban migrants in less-developed countries.[87] It has been noted that to understand undocumented Mexican migration to the United States would require models of both the American and Mexican societies.

Many undocumented Mexican aliens are coming to the United States to seek work. The United States was the destination they chose after they considered other possibilities such as Monterey or Mexico City. An understanding of what motivates many of Mexico's rural-to-urban migrants to favor U.S. destinations is crucial to predicting the level of future migration. Current levels of undocumented Mexican migration were not predicted years ago. Today, general knowledge about the process of migration from rural to urban places in less developed countries aids the understanding of current Mexican migration.[83-85] Studies currently underway concerning the causes of migration from the Caribbean Basin and the adjustment process of the migrants (both documented and undocumented) will further increase the understanding of this phenomenon.[88-96]

Research on migration in the United States is informative about many other phenomena. By using studies of the interrelated causes of residential mobility, such as job satisfaction, housing satisfaction, household structure, and kin connections,[38] policymakers can become informed about the implications for future population change and economic growth, such as fluctuations in the mortgage market. Research on the subject of the relation between residential mobility and school desegregation[97] suggests the types of desegregation programs that are likely to be successful.

When a decline in population growth occurs, the decline is not uniform everywhere. The dramatic shift in the U.S. population to nonmetropolitan areas and to the South has many implications for future patterns of economic, social, and psychological development.[98-102]

Shifts in population to nonmetropolitan areas have taken a number of forms, each of which has major impacts on local areas. In "metropolitan spillover," the familiar pattern of suburban and exurban growth has extended into lands surrounding presently defined metropolitan areas. With recent improvements in transportation, such as the interstate highway system, feasible commuting distances have increased, and with improvements in communication, branches of businesses no longer need to be in physical proximity. Movement out of large metropolitan centers and into smaller

centers has occurred. Additionally, migrants have begun to favor destinations that are truly rural, such as northern New Hampshire, Upper Michigan, the Ozarks, and the Sierra Nevada foothills. The total number of migrants involved in this so-called "rural renaissance" is small, but since the populations of the communities into which they are moving are also small, even a few new residents can have a sharp impact.

The patterns of change in population distribution in the United States have a number of implications for future demands for health care. Newcomers settling in nonmetropolitan areas tend to be more affluent and more highly educated than the populations they join, and although they enjoy living in a rural setting, they want access to modern medical care. In this era of efficient transportation, they can easily go to a major metropolitan center for treatment of a serious health problem, but they still want trained medical specialists to be readily available for consultation and treatment of less serious matters. It is not yet clear whether medical personnel will migrate to nonmetropolitan areas at the same rate as has the rest of the population and whether they will distribute themselves in a manner that is optimal for the rural population. In a major city of 2 million people, it is fairly easy for a resident to reach a given physician regardless of her or his location, and the physician has a population of 2 million to draw from as potential patients. In a rural area, however, only a few thousand people may be spread over an area of 1,000 square miles. The typical rural resident has to travel farther to reach a physician, and the physician must draw from a much larger geographic base to obtain a potential patient population of a given size.

Just as migration patterns influence where the general population lives, they also influence accessibility to health care because of migration patterns of health professionals. The National Health Service Corps (NHSC) assigns health professionals to medically underserved areas of the United States and encourages practitioners, upon completion of their terms, to remain in the community in private practice. Government statistics indicate that only about 5 percent of NHSC physicians did so or planned to do so.[103] Small towns that are not truly rural, however, seem to have increasing numbers of qualified medical personnel. Over 70 percent of nonmetropolitan communities with 20,000-30,000 residents now have a board-certified internist, surgeon, pediatrician, obstetrician/gynecologist, and radiologist in residence.

The factors are not clearly identified that make a given potential nonmetropolitan destination attractive or unattractive to the population in general or to special groups, such as physicians, in particular.

Population Composition and Change

A population can be analyzed on the basis of the distribution of its social characteristics, such as ethnicity, race, sex, age, and educational level, and researchers have long been concerned with sorting out the compositional factors that underlie a demographic phenomenon. Researchers have been concerned, for instance, over the effect that changing female educational levels will have on levels of women's earnings. It is true that persons with a higher educational level usually have a higher income than those with a lower educational level. In the United States, where women, in general, have a lower educational level than men, women would be expected to have a lower income. Differences in male and female educational levels, however, cannot account completely for differences in male and female income, and the discrepancy points to a needed search for factors outside questions of educational composition, such as discrimination or differing job preferences. Similarly, in this century, persons with lower occupational status and education generally have had more children than persons with higher occupational status and a higher educational level. Basic research within the topic of population composition and change[104-106] with reference to patterns and determinants of female labor force participation has been helpful in understanding the complex interrelations among female labor force participation, fertility, household migration decisionmaking, and changing labor markets.[107-109]

Considerable interest has arisen concerning the timing of demographic behaviors in the lives of individuals, especially as the timing relates to passages through various stages of the life cycle,[110] and research on both fertility and migration has been from the perspective that the two must be viewed as life-cycle phenomena. A change in timing of fertility, for instance, may be as important as a change in the average number of children born per couple. Attention has also focused on the timing of fertility in less developed countries.[111] Almost everyone in some less developed countries migrates from his or her home village at least temporarily. In such instances, the question of who is a migrant and who is a nonmigrant, is useless; the valid question targets <u>when</u> persons migrate. Overall, questions of the timing of demographic behaviors are assuming increasing importance.

Recent research suggests that different population subgroups do not react in the same manner to essentially identical social changes. Studying Belgian data from the 19th century, Lesthaeghe[39] found that in the French-speaking area, higher education was related to earlier adoption of fertility control, and that in the Flemish-speaking area, higher education was related to later adoption of voluntary

fertility control. When different population subgroups respond in opposite directions to a given social change, subgroup identification takes on importance and cannot be treated as a minor variable. The United States has a long immigrant tradition, and ethnicity has been an important factor in explaining demographic behavior. In the past, it was thought that after a family had been in the United States for a number of generations, ethnicity would no longer matter, but the recent increased awareness of ethnicity in the United States among persons who are many generations removed from their foreign origins suggests that ethnic identification is not likely to disappear simply with the passage of time. The full significance of rising ethnic awareness in relation to social and demographic patterns, both among those who have recently come to this country and among those whose families have been here for many generations, remains to be seen.

The recent decline in fertility in the United States has been closely connected to changes in household and family composition. This decline has been partially the result of an increase in childless and one-child families. It is not completely clear how one is affected by being an only child or how a couple is affected by having no children or only one child. Sociological and psychological research on these questions should soon tell more about the effects of these fertility changes.[62,112-120]

The composition of the United States population is changing by age and by household type, in part as a result of recent changes in fertility and mortality and in part as a result of fertility patterns of the past. In particular, for a number of reasons, the population is growing considerably older. The recent increases in life expectancy contribute to a rise in the proportion of the population at older ages. Similarly, the recent declines in fertility contribute to a decrease in the proportion of the population at young ages. Most importantly, the large number of infants born during the baby boom are now young adults, and as they mature they constitute a bulge in age distribution over time. In 2010, the baby-boom generation will begin to turn 65. Unless fertility increases radically between now and then, the proportion of the population at older ages will increase rapidly at that time. Such changes in the age composition of the population are likely to have major effects, some of which are not now completely understood.[99]

An understanding of the nature of likely future changes in age composition and the effects of these changes is essential to formulate reasonable and workable public policies relating to such areas as employment, retirement, and health care. Substantial effects on demands for health care are certain. If the U.S. population of 220 million in 1979

were distributed by age as it is likely to be in the year 2030, on the basis of current rates of short-stay hospital utilization by age, it would spend 24 percent more days in hospitals than are now spent. At the same time, the size of the population in the prime working ages will shrink while the population eligible for Social Security benefits will grow.

Two conferences have been sponsored on the consequences and implications of slowed population growth, both of which have led to the publication of monographs (Espenshade and Serow, editors, The Economic Consequences of Slowing Population Growth, Academic Press, New York, 1978, and Campbell, editor, Social, Economic and Health Aspects of Low Fertility, Washington, D.C., Government Printing Office, 1980). A topic of interest is the effect on economic behavior and institutions of changes in the size and structure of the population, measured at levels of both the individual and household.[8,9,11,121] Another concerns the relation between demographic factors and investment, savings, capital accumulation, and consumption.[122-127] Investigators are also examining the effects of slowing population growth on the labor force with respect to changes in the size, structure, participation, and productivity of the labor force. Slowing population growth may also have implications for the general incidence of poverty and the distribution of income and wealth.[125] Such effects as well as the relation between population change and Federal, state, and local health expenditures are important subjects of research.[120,129]

It was not clear in the late 1950s how long the baby boom would continue, and the United States faced problems of a rapidly growing population. Today, fertility and mortality rates indicate steadily slower rates of growth and eventual stabilization at a constant, although larger, population size. If young women continue to postpone their childbearing and if substantial numbers remain childless, this convergence to a constant size will occur even sooner.

The structure of the U.S. population is changing not only because of the major changes in fertility, mortality, and migration in the recent past, but also because of rapid changes in living arrangements. Thirteen percent of the first marriages that occurred in the period 1900-1904 ended in divorce, and it is estimated that 34 to 38 percent of the first marriages that occurred in the period 1945-1949 will end in divorce.[130] The rising divorce rate means that larger proportions of children are spending at least part of their lives in a single parent household. Such experiences may have long-lasting effects, and studies of these changes will add to the understanding of their effects on subsequent fertility behavior and on the well-being of children.[131-135]

Models of demographic interrelations and population change are a great help in discerning the effects of various combinations of demographic and social phenomena, even the effects of combinations that have never occurred in an actual society.[13-15,18,19,78,136-139] These models have generally incorporated fertility and mortality changes and patterns in a sophisticated fashion. Models of migration and of interactions between migration and social and economic phenomena, however, have been less fully developed.

IV. Future Directions

Overarching Issues

Comparative Analyses

This report has already addressed the advantages of comparative analyses. The risks of misinterpretation of results from a single case study, even when the single case is an entire country, are well known. Researchers are now in a position to make advances as a result of the increasing availability of comparable data sets. The World Fertility Survey data, for example, will facilitate cross-cultural studies both within and between developed and developing countries. This research could involve collaboration between an American scientist and scientists from countries to which the data refer. Likely topics for study include fertility as well as some aspects of mortality, family structure, and migration. There are also increased opportunities for comparative studies of current and past societies. As a result of recent efforts to create tapes for public use from early United States censuses, scientists will be able to conduct more sophisticated comparative analyses than were previously possible.

Timing

There has been a growing interest in the effects of timing of events as well as the occurrence of events. The timing of childbearing and migration, for instance, may be more important than the total number of children born to a woman or whether a person ever migrates. The fact that a woman may have two children in the course of her life is of little significance compared to whether she is, for example, aged 18 and 21 or aged 30 and 40 when the children are born. Younger ages at childbirth result in a much higher

population growth rate and a shorter average length of generation. Similarly, most people migrate at some time in their lives. It matters more when a person migrates and how frequently than whether he or she ever migrates. Analyses of questions of timing require a life cycle approach and sophisticated time series methods of analysis.

Decisionmaking

An understanding of the decisionmaking processes regarding fertility, migration, and household structure requires an integrated study of the characteristics of the individual, the household, and the village or other larger environment in which a person lives. Planning for appropriate data for these questions is complicated, and the research involves the coordination of data collection from several household members and on the characteristics of the community as a whole. Analysis of the results is also complex, and the entire process requires the professional skills of economists, sociologists, psychologists, and anthropologists.

Methodology

The methodology of population science must keep pace with the increasing complexity and sophistication of demographic questions, and improvements in methodology are vital for addressing future questions. Advances are now needed, for example, in the modeling of interrelations between demographic and social processes, and in the development of new methods for analyzing increases in life expectancy at older ages. Research on the ways in which family structure and family interrelations are translated into fertility or migration decisions has often been hampered by problems in measuring social psychological variables, such as attitudes toward children or intentions for future behavior. The development of better measures would facilitate substantive work in all these areas.

Data Collection

Agencies collect population-relevant data for many purposes. In the past, the usefulness of data sets for demographic analysis has been increased by the addition of a

few questions. Additions to the Bureau of the Census' Current Population Survey, for instance, have generated data useful in the analysis of fertility. The population relevance of other data sets, such as the Consumer Expenditure Survey, has also been enhanced. Still other data sets can be made more useful by modest investments for documenting data tapes, developing software, and improving the distribution of data tapes.

Ethnicity

Analyses of the United States population have generally taken racial diversity into account, but they have been inadequate in studying other aspects of ethnicity, especially in drawing comparisons not only between Hispanics and non-Hispanics but also within the Hispanic population itself. It is clear that ethnic and cultural differences among population subgroups affect their socioeconomic statuses, fertility, migration, and mortality. Research on ethnicity and population behavior, both in the United States and in other countries, will increase the basic understanding of processes and will inform policymakers who wish to respond to needs of ethnic groups. Data and analysis problems are more complicated for ethnic studies than they are for simple comparisons among racial groups.

Specific Areas

Fertility and Family Planning

Substantial research on fertility and family planning should continue. Several topics of longstanding interest are important for future work, and new research topics have emerged. Those of prime interest are described below.

Delayed Childbearing

Partly because many young adults appear to be delaying the initiation of childbearing, present fertility rates in the United States are very low. How these young adults behave in the coming 5 to 10 years will have far-reaching implications for the future size of the population and its age composition, and for social institutions, individuals, and families. Prime subjects for research are the process

of deciding to delay a first birth and to have that birth after age 25 or later, the role of medical technologies in that decisionmaking, and the consequences of such delays.

Childbearing and the Labor Force

Female labor force participation and a constellation of economic factors are closely related to fertility decisions and to the consequences of fertility for individuals, families, and society. Labor force participation of mothers of school-age children grew at a spectacular rate in the 1970s, and insufficient attention has been given to the full impact on the family of combining mother and worker roles and to the influence of childcare arrangements on fertility itself.

Teenage Fertility

While research on the consequences of adolescent fertility has made major strides in the past decade, research on the antecedents of the behavior has been less well developed. The high risk of pregnancy early in an adolescent's sexual experience implies the need for research on the role of parents and schools, and on the role of the teenager and the system that provides methods for regulating fertility to prevent unwanted pregnancies.

Low Fertility

In previous decades, research on fertility in the United States and other developed countries has been focused on unwanted and unintended childbearing of married couples. While this topic is of continuing concern, the causes and consequences of low fertility, especially childless and one-child families, raise new issues for research. As the frequency of these family forms increases, the need to understand the implications of this behavior increases. Such research will require life-cycle approaches, studies of both men and women, and comparative studies, both cross-cultural and historical.

Out-of-Wedlock Births

In the United States and other developed countries, there are growing numbers and proportions of out-of-wedlock

births. There is also an increasing number of women in the years of highest risk for such births. The causes of the increase in out-of-wedlock births and the meaning of the births for the mothers, the fathers, the children, and relatives are not well understood and need attention.

Contraception

A priority research question is how to increase the knowledge and use of currently available methods of contraception. Such research should focus not only on the user but also on the relationship of the user to the partner, on the influence of publicity on methods and their risks, and on the influence of providers of service on the selection and successful use of currently available methods, including barrier methods, sterilization, and natural family planning. Research on the practice of contraception should also be focused on groups that have received little attention, such as unmarried young adults, males, Hispanics, and women who have recently had an induced abortion, or have high rates of unintended pregnancies.

Infertility

Studies of infertility are needed, and they should include the effect of involuntary infertility, the psychological consequences of infertility, and fertility treatment programs, in both developed and developing countries. Infertility is often a cause of anguish for couples, and doubts about future fertility prospects may impede the use of contraception. Research also needs to be done on infertility as a motivation for adoption and on the causes and consequences of adoption. Additionally, the process of voluntary sterilization requires further study in assessing the personal, familial, and demographic implications of voluntary infertility.

Mortality

Mortality research has received much less attention in the past decade than has fertility research, and future mortality research will often require cooperation with other agencies. Outlined below are specific topics of potentially fruitful study.

Sex Differences

The movement of women into traditionally male occupations and their changing patterns of labor force participation may influence their patterns of mortality and morbidity, and the subject needs major attention. Such analyses are complicated methodologically by the occupational concentration of women.

Age-Specific Mortality Changes

Reductions in infant mortality due in part to increased viability of very low birthweight infants have a long-range impact on the age structure. Also, recent reductions in male death rates at the older ages have been sufficiently large to cause the Census Bureau to revise its population projections upward. Changes in age-specific mortality must be studied to advance the understanding of population trends, future population size and structure, and the relationship of the population to social institutions, such as health care delivery systems and medical and health research programs.

Living Arrangements

Because social relationships and living arrangements are appearing as important correlates of mortality and morbidity, the study of the individual in a family or household setting is especially important in the study of mortality. Techniques for analyzing data for research of this nature need to be improved, and data bases themselves need to be enlarged.

Mortality Differentials

Mortality levels in the United States differ by geographic location, socioeconomic characteristics, and racial/ethnic characteristics. Research is needed on the sources of the differentials, and it requires analyses by area and analyses of various groups by cause of death. Especially important is the relation of such differentials to access to preventive health care and to curative health care.

Mortality and Public Health

The mortality decline in developing countries as compared to that of the United States and other developed

countries raises important basic questions about its causes and about the relation of mortality decline and morbidity decline. Studies show that public health measures have been more important in developing than in developed countries, but the actual role of public health measures and general increases in the standard of living as compared to the role of medical technology and individual medical care is not clear. Furthermore, while death rates have declined in developing countries, morbidity rates, especially from chronic ailments, do not seem to have declined commensurately. It is unclear whether the current conditions leading to low mortality in developing countries are in a fragile state that could easily be disrupted. Research on these questions would clarify the general understanding of mortality, and the interrelations of mortality with morbidity, the nature of social change, and the types of public health programs that have been implemented.

Migration and Population Redistribution

Migration has become an important part of population change both in the United States and in the rest of the world. Prime areas for future research in migration and population redistribution are described below.

Adjustment

International migration is a large part of population growth in the United States. Understanding the process of adjustment of the migrants to life in a new setting is essential for the formulation of reasonable policies to facilitate successful adjustment. The process by which migrants change, such as changes in fertility, mortality, and social status, should be understood more fully. The effects of various patterns of resettlement on successful adjustment are also not well understood, and research is greatly needed on these processes with reference to the United States and to other countries, internally and internationally.

Models of International Migration

Although much immigration to the United States is predictable and can be planned for, substantial numbers of immigrants, both documented and undocumented, are unexpected even a short time before their arrival. The development of

improved models of the stock and flow of immigrants, although difficult to formulate, would greatly facilitate public planning. The development of such models would require research by economists, sociologists, geographers, and others.

Redistribution

Population redistribution patterns in the United States have changed. The long-term net transfer of persons from nonmetropolitan to metropolitan areas has reversed to a net transfer from metropolitan to nonmetropolitan areas. Similarly, while the Sunbelt for a long time lost population, this region is now a net gainer. Some of the changes in population redistribution result from changing tastes for lifestyles and from an increased value placed on leisure. Other causes relate to the changing distribution of industry within the United States. The relative importance of noneconomic factors, such as leisure preference, is presently unclear as compared to essentially economic factors. In addition, part of the change results from fewer people migrating from the Sunbelt and from nonmetropolitan areas than in the past. The causes of a lack of migration are not the same as the causes of migration. A better understanding of the underlying causes of these changes would contribute to projections of the extent to which the patterns are likely to continue in the future.

Temporary and Repeated Moves

In both the United States and other countries, a large proportion of total population mobility is the result of frequent moves by a relatively small part of the population. Such temporary and repeated movement may waste resources in adjusting to a new environment and may strain public facilities. On the other hand, migrants may be a source of new information and innovation. The overall causes and consequences of such temporary and repeated movements are not well understood and should be studied.

Population Composition and Change

Many questions in the area of population composition and change relate to important interconnections among the various areas of population dynamics and appeared above in the section headed "Overarching Issues." Additional important questions for work in this area are described below.

Living Arrangements

During the past decade, the living arrangements of the American population changed radically; the divorce rate has increased, and preferences of persons for living alone or with nonrelatives rather than relatives have changed. These changes have substantial effects on the children and on the adults involved. Given types of households have also changed their preferences for residential location. Urban couples without children are not moving out of cities even after their incomes would support suburban living. A better understanding of the determinants and consequences of various living arrangements, both in the United States and elsewhere, will help predict what the long-term patterns and consequences of the patterns are likely to be.

Slowing Population Growth

In the recent past, the rate of U.S. population growth has slowed and the population has grown considerably older. These changes are likely to continue. Research on the consequences of a reduced rate of growth, likely vacillations in cohort size, and changing age composition of the population is needed.

Environmental Factors

The relation of the environment to the population is an important topic. Epidemiologic studies can address the links of environmental characteristics, such as type and level of air pollution, to mortality. It also seems likely that fertility and migration decisions are being affected by preferences for raising children and living in various kinds of environment. The extent to which the population actually responds to characteristics of the environment is largely unknown, however, and studies of the questions are important for the planning of efficient future use of natural resources.

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Wayne A. Cornelius, Massachusetts Institute of Technology, Cambridge, Mass. 02139.

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